I see no need, and indeed it seems to me a great disadvantage, to divide the publication into separate series. Each experiment station and each other large research institution, many libraries and many individuals, will desire the whole publication. Citation should be to the journal as a whole and not to separate series. If division into series be attempted their boundaries will be artificial and their number will be constantly changing and no stability will be secured.

Issuance in series will also inevitably lead to delay. The only advantage of such a series will be that each investigator may receive only the series concerning his particular field. This end may be attained with even greater accuracy by issuing each article as a special number of the journal, and sending to subscribers only such numbers as contain articles pertinent to the subscriber's interest. In this I incline to the view expressed by Bailey[2] and avoid the difficulties raised by Gilmore[3] and by Webber himself.

If there be no separate series of the journal the editorial board would need to be enlarged to include one or more men in each special field of research. These editors should be paid sufficient compensation to make it their duty to give *immediate attention* to each article submitted to them, and thus to facilitate publication.

Numbers upon designated subjects should be sold to station workers at a price sufficient to control actual waste, but low enough to be without burden to the subscriber, as, say, 25 per cent. of actual cost.

F. L. STEVENS
Vegetable Pathologist

N. C. EXPERIMENT STATION

HOLOTHURIAN NAMES

TO THE EDITOR OF SCIENCE: In reference to the letters by Dr. Theo. Gill and Dr. W. K. Fisher in SCIENCE for August 7 and September 20, respectively, I would ask whether Dr. Fisher's conclusion that "we can no longer speak of sea-cucumbers as 'holothurians,' nor of the class as *Holothurioidea*" is really justified.

[2] SCIENCE, Vol. XXVI., p. 512.

[3] SCIENCE, Vol. XXVI., p. 511.

Even if the name *Holothuria* be taken up by the writers on Cœlentera, is there any reason why we should not continue the use of what has now become an ordinary English word? And as regards the name of the class, I would protest against the assumption that this must necessarily be based on the name of one of the families or one of the genera included in the class.

It is generally held that the word ὁλοθούριον, used by Aristotle ("Historia Animalium," I., i., 19, and "Partes Animalium," IV., v., 43), as well as the word *Holothurium*, used by Pliny ("Naturalis Historiæ," Liber I., Cap. xlvii.), refer to a sea-cucumber. This is surely enough to justify the continued use of the class name Holothurioidea.

Since in these days the genus *Holothuria* has become so much split up that it would in any case be difficult to decide for which of its sections the name *Holothuria* should be retained, the disappearance of the name from systematic usage is by no means to be regretted. As for the possible transference of the name *Holothuria* to either a pelagic hydroid or a tunicate, this appears to be eminently one of those cases which should be disposed of by an international committee, such as it was proposed should be established by the International Zoological Congress. I am not aware whether such a committee was actually appointed.

Both your correspondents seem to have overlooked the fact that the absurdities following a rigid adherence to rule in this matter were well put by my colleague Mr. F. Jeffrey Bell in his note "A Test Case for the Law of Priority" (*Annals and Magazine of Natural History*, pp. 108–109; July, 1891).

F. A. BATHER

LONDON

SPECIAL ARTICLES

A SUGGESTION FOR A NEW UNIT OF ENERGY[1]

THE study of the food of man and of animals as a source of energy to the organism has made rapid progress within recent years. It is, of course, easy to overestimate the value

[1] Read before the Society for the Promotion of Agricultural Science at its annual meeting, May 27, 1907.

of a new method or a new point of view, and we must beware of assuming that a study of food energy will solve all the problems of nutrition. At the same time, the new method, while not a panacea, has proved a most useful instrument which seems likely to be employed to an increasing extent.

The unit of energy commonly employed in such studies is either the large or small calorie. This arises naturally from the fact that in order to measure the quantities of energy involved we ordinarily convert them into heat. The use of the calorie as a unit is, therefore, convenient in avoiding a recalculation of results, in spite of its unfortunate suggestion that we are dealing with energy in the animal body in the form of heat only.

In practical use in connection with the feeding of domestic animals and the computation of their rations, however, the calorie is an inconveniently small unit. To express the energy values of feeding stuffs per pound in kilogram calories requires rarely less than three integers and usually four, while the energy values of rations computed per 1,000 pounds live weight, as is the usual custom, practically never require less than five integers. Taking, for example, the maintenance requirement, which is about the smallest quantity of energy which we need to express in practise, the average of Kellner's determinations for cattle is 13,469 calories of metabolizable energy per head, or 21,312 calories per 1,000 kgs. A ration for productive purposes, of course, would require the use of still larger numbers. These large numbers are inconvenient in computation, and differ so much in appearance from those which have previously been used that it is likely to be difficult to bring them into common use.

To meet this difficulty Kellner has proposed the use of "starch values" to express the production values of feeding stuffs as determined according to his method. The starch value of a feeding stuff means, in brief, the amount of pure starch which would produce the same energy effect as a unit weight of the feed in question. Computed per 100 units, the starch values give figures comparable with the percentages of total digestible matter heretofore used, commonly requiring two integers for their expression.

There are, however, certain objections to this method of expression, and to the writer it seems preferable, if we are to attempt to deal with energy values at all, to do so boldly and to employ a unit of energy rather than a unit of matter. To do so conveniently, as already indicated, it is desirable to have a larger unit, and the object of this paper is to suggest such a unit for discussion and to indicate by one or two examples how it could be used.

The unit which I suggest is 1,000 kilogram calories, for which I propose the designation *Therm.* The word therm has already been proposed as the equivalent of the small or gram caloric, but does not appear to have come into general use. Following the analogy of the calorie, we may write the unit here proposed with a capital and use the capital or full-face **T** as a convenient abbreviation. The relation of the units would then be

1 therm (t)	= 1 gram-calorie (cal.).
1,000 cals.	= 1 kilogram-calorie (Cal.).
1,000 Cals.	= 1 Therm (**T**).

While a sense of strangeness and awkwardness of course attaches to the proposed as to any new term, it seems better, if a new unit is to be used at all, to give it a new name rather than to employ any modification of the word calorie, which would be likely to produce confusion. It may be objected that the suggested unit is not a C.G.S. unit, but while this is true, a thermal unit is practically more convenient, partly because, as already pointed out, our determinations of energy are usually made in thermal units and in part because any available C.G.S. units are rather small.

As an example of the use of the suggested new unit, I have taken three samples of feeding stuffs whose energy values have been determined at the Pennsylvania Experiment Station, namely, timothy hay, clover hay and corn meal. The composition and digestibility of these feeding stuffs per 100 pounds as expressed by the ordinary method, and also the energy values of the same quantity, are shown in the following table:

In 100 Pounds

	Timothy Hay. Pounds	Clover Hay. Pounds	Corn meal. Pounds
Composition			
Water	15.00	15.00	15.00
Ash	3.94	5.58	1.23
Proteids	4.34	9.50	8.67
Non-proteids	0.20	0.76	0.25
Crude fiber	33.08	24.46	1.86
Nitrogen-free extract	41.67	42.21	69.40
Ether extract	1.77	2.49	3.59
	100.00	100.00	100.00
Digestible nutrients			
Proteids	1.57	5.13	5.76
Carbohydrates	44.06	42.24	68.44
Fat	0.63	1.59	3.44
	46.28	48.96	77.64
Energy			
Fuel values	77.70 **T**	80.17 **T**	132.68 **T**
Maintenance values	48.89 "	58.54 "	103.30 "
Production values	25.87 "		70.72 "

The maintenance values of feeding stuffs will seldom require more than two integers for their expression in the new unit and the production values, I think, never. Expressed in this way, these values have quite the appearance and effect of percentages. It is true that if expressed per 100 kgs. instead of per 100 pounds the numbers would be somewhat unwieldy, but the actual adoption of the metric system in this country still seems distant. The reason for expressing the values per 100 pounds instead of per pound will appear if we consider the use of these figures in the computation of rations.

As a simple case let us suppose we have a ration consisting of 12 pounds of timothy hay and 18 pounds of corn meal, and that we desire to compute its production value on the basis of these tables.

The ordinary method of computing the digestible nutrients is illustrated in the first half of the subjoined table. The calculation is identical with the one with which we are already familiar, with the single exception that the number of pounds of the feeding stuff is expressed as a fraction of 100 pounds. In other words, the transposition of the decimal point is made in this number and not in the figures for the percentages.

The second portion of the table shows the computation of the ration on the basis of its energy value. But a glance is needed to show that the two are precisely similar and that the units of energy can be handled in this way in a manner precisely analogous to the manner in which protein, carbohydrates and fat are handled.

The total ration, therefore, would be as tabulated in the second table.

	Timothy Hay. Pounds	Corn meal Pounds
Digestible nutrients		
Dry matter	85.00 x 0.12 = 10.20	85.00 x 0.18 = 15.30
Digestible		
Proteids	1.57 x 0.12 = 0.19	5.76 x 0.18 = 1.04
Carbohydrates	44.08 x 0.12 = 5.29	68.44 x 0.18 = 12.32
Fat	0.63 x 0.12 = 0.08	3.44 x 0.18 = 0.62
Total	46.26 5.56	77.64 13.98
Production values		
Dry matter	85 00 x 0.12 = 10.20	85.00 x 0.18 = 15.30
Digestible		
Proteids	1.57 x 0.12 = 0.19	5.76 x 0.18 = 1.04
	Therms	Therms
Production value	25 87 x 0.12 = 3.10	70.72 x 0.18 = 12.73

Computed Ration

	Dry Matter	Digestible Proteids	Production Value
12 lbs. timothy hay	10.20 lbs.	0.19 lb.	3.10 **T**
18 " corn meal	15.30 "	1.04 lbs.	12.73 "
	25.50 "	1.23 "	15.83 "

Finally it should be noted that it is not the relative value of these two methods of expressing the content of feeding stuffs or rations which is here in question. Assuming the desirability of the use of units of energy, the purpose is to show that the manner of using them according to this scheme is quite similar to the familiar methods of computing rations, so that the transition from one system to the other should be comparatively easy, while the use of large figures is avoided. The writer would be grateful to receive the fullest criticism, both in general as regards the utility of such a unit and specifically as to the suitability of the one proposed and the propriety of the name suggested.

HENRY PRENTISS ARMSBY
STATE COLLEGE, PA.

THE FLYING MACHINE

THE fact that a machine of the aeroplane type built entirely of metal and canvas may be made to fly by the power of an ordinary